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COIR FIBRE PITH AS A GROUND COVER IN COCONUT PLANTATIONS OF ANDIGAMA SHALLOW SOILS IN SRI LANKA: AN *EX-POST* FINANCIAL ANALYSIS

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ABSTRACT

The financial feasibility of ground cover management using coir fibre pith as a dead mulch was examined in this study. An experiment, on a 13-years old coconut plantation, conducted from 1997-2002, at Ratmalagara Estate, Madampe (IL_1/S_4 to S_5); was the source of primary data. Input and output prices that prevailed during 1997-2002 were used in the analyses. The incremental Net Present Value (NPV) of this practice was Rs 16 982 per ac per 6 years; Benefit Cost Ratio (BCR) was 1.72, and the Internal Rate of Return (IRR) was 62%, testifying that this investment was financially feasible. According to the sensitivity analysis the project is not worthwhile if the coconut prices decrease by over 45 % resulting in a negative NPV and a BCR of less than one. On the other hand, the project would remain viable even if the coir fibre pith price increases by 104%. With a relatively high IRR of 62%, the project has a low sensitivity to interest rate changes. Of the parameters tested, this project is most sensitive to changes in the price of coconuts. Considering the prices obtained for coconuts during the study period, it is clear, that mulching coconut plantations in Andigama shallow soil with coir fibre pith is financially viable.

INTRODUCTION

A 13-years-old T x T coconut plantation established in 1984, on a shallow Andigama series soil (S_4-S_5), at Ratmalagara Estate, Madampe (IL1), exhibited retarded growth. The young plantation had been interplanted with *Brachiaria brizantha*, an improved pasture variety. The rank growth of the residual pasture and consequent competition for soil moisture was thought to be the likely cause of retardation. This led to an investigation on the effect of different ground cover management systems on soil moisture, palm water status and the performance of coconut on the degraded Andigama shallow soils where soil moisture appears to be a major limiting factor for increasing coconut yield (Dassanayake et al, 1997). An experiment was established in Ratmalagara Estate, Madampe in 1997; the treatments were:

T_1 - Complete removal of undergrowth (bare ground)
T_2 - Standard estate practice - *B. brizantha* controlled by slashing 4 times a year
T_3 - Uncontrolled *B. brizantha* pasture
T_4 - *Pueraria* cover crop as a live mulch
T_5 - Ground cover with coir fibre pith (5 cm thick) as a dead mulch

Although this investigation has not yet fully determined the cause for growth retardation, significant ancillary findings have emerged. Palms mulched with coir fibre pith gave the highest coconut yield, and had the highest rate of transpiration and the lowest stomatal resistance during the dry period. This indicates that a dead mulch is more effective in conserving soil moisture than live ground covers, and that adequate soil moisture was available in the coir fibre pith mulched plots during the dry period (Anonymous, 1998-2002). It is evident from the summary of yield data presented in Table 1 that the coir fibre pith treatment produced the best results.

Table 1: Effect of ground covers on coconut yield

Treatment	Pre-treatment block yield (nuts/palm/year)			Number of nuts/palm/year				
	1995	1996	1997	1998	1999	2000	2001	2002
T1				36	60	70	66	33
T2				31	41	70	65	50
T3				28	43	71	58	47
T4				37	50	85	67	62
T5				35	69	97*	79	71*
Mean	24	20	25	33	53	79	67	53

Notes: *significant.

Source: Annual Report of Coconut Research Institute of Sri Lanka (1997 and 2002).

Although experimental evidence points to better yields from a ground cover of coir fibre pith, implementing this practice entails a considerable expenditure. Growers have to purchase coir fibre pith from fibre mills and transport it to their lands. The price of coir fibre pith has been increasing steadily during past few years due to the increasing demand by the coir fibre pith briquette industry. It is therefore, prudent to evaluate the financial feasibility of using coir fibre pith as a ground cover in a coconut plantation. This study seeks to make such an evaluation in respect of a plantation established in a degraded shallow Andigama series soil.

METHODOLOGY

Data

Data of the experiment noted above were utilized for this evaluation (Dassanayake *et.al*, 1997). In the benefit-cost analysis, yield data, and the incremental costs and benefits of the coir fibre pith mulching practice (T_5) was compared with those of the standard estate practice (T_2). Yield data and the costs of coir fibre pith and its transportation, and the cost of weeding (T_2) were the actual expenditure incurred in the experimental plots. The additional costs for spreading of coir fibre pith; and harvesting, collecting, counting and stock piling of incremental coconut yield were the norms set by Ratmalagara Estate. Nut prices were *as per* sales records of Ratmalagara Estate. Table 2 shows the incremental costs incurred and incremental benefits accrued for this investment in summarized form (see Annex Table A1 for details).

Analysis

The incremental costs and benefits flow was used to find out whether coir fibre pith mulching is financially feasible or not (Gittinger, 1982). Present value approach, benefit-cost ratio (BCR) and internal rate of return (IRR) were used to determine the financial feasibility of the investment.

The effects of a coir fibre pith mulch lasts for several years. Therefore, the benefits of the investment will be realized over several years in the future. However, the value of money changes with time. Hence, the present worth of that future income stream must be determined, to decide whether the investment project is worthwhile. For the grower, money earned in the future brings less benefit than if he had the same amount today. Therefore, in order to compare costs and benefits of different years, it becomes necessary to estimate all the future earnings and costs of the investment, and then convert them to their present value. The process of finding the present worth of a future value is called discounting. Discounting is essentially a technique by which one can "reduce" future benefit and cost streams to their "present value".

Table 2: Incremental costs and benefits

Year	Activity	Unit price (Rs)	Incremental cost (Rs/ac)	Incremental benefit (Rs/ac)
1997	Spreading of coir fibre pith	102/md	1 888	
	Coir fibre pith	500/4WT load	5 444	
1998	Collection, counting and stock pilling of nuts	116/md	14	
	Income from incremental yield	7.97/nut		2 040
	Decrease in cost of weeding			532
	Internal field transportation	110/1 000 nuts	28	
1999	Collection, counting and stock pilling of nuts	133/md	110	
	Income from incremental yield	8.43/nut		15 107
	Decrease in cost of weeding			748
	Internal field transportation	115/1 000 nuts	206	
2000	Spreading of coir fibre pith	133/md	5 081	
	Collection, counting and stock pilling of nuts	133/md	106	
	Coir fibre pith	850/4WT load	13 883	
	Income from incremental yield	4.17/nut		7 206
	Decrease in cost of weeding			954
	Internal field transportation	120/1 000 nuts	207	
2001	Collection, counting and stock pilling of nuts	182/md	75	
	Income from incremental yield	8.31/nut		7 446
	Decrease in cost of weeding			1 373
	Internal field transportation	125/1 000 nuts	112	
2002	Collection, counting and stock pilling of nuts	182/md	112	
	Income from incremental yield	12.05/nut		16 195
	Decrease in cost of weeding			1 244
	Internal field transportation	130/1 000 nuts	175	

Notes: md - man-days.
4WT - four wheel tractor.

Source: Records of the Ground cover experiment of CRISL (1997-2002).

(i) Net Present Value (NPV)

The difference between the present value of the benefits and present value of the costs of the investment, is known as the Net Present Value (NPV). Here, mulching the ground with coir fibre pith was considered as the investment, and the incremental coconut yields and the reduced weeding costs of the mulched ground were considered as returns to the investment.

$$NPV = \sum_{t=1}^{n} \frac{B_t - C_t}{(1+r)^t} \quad \text{——————} \quad (1)$$

Where;

B_t = Yearly incremental benefits
C_t = Cost of mulching with coir fibre pith in each year
n = Duration of the project, in years
r = Discount rate as a percentage

If the NPV of a project is a positive value, it provides a justification for accepting the project.

(ii) Benefit-Cost Ratio (BCR)

NPV gives an overall idea of the financial feasibility of the project. But it does not inform the grower on the return for each Rupee invested on this practice. To serve this purpose the BCR was calculated using the formula:

$$BCR = \frac{\sum_{t=1}^{n} B_t / (1+r)^t}{\sum_{t=1}^{n} C_t / (1+r)^t} \quad \text{——————} \quad (2)$$

The notations are same as in equation (1).

If the BCR is greater than one, the investment is worthwhile.

(iii) Internal Rate of Return (IRR)

Rate of return approach was used to decide whether it was more profitable to invest money on this practice or deposit the money in a bank, at the current interest rate. IRR is the value of the discount rate at which the NPV equals the cost of investment. In other words, the rate of discount that would make the investment just break even. If the market rate of interest is less than IRR, the investment is profitable. The grower should go ahead with the investment as he would be better off investing money in this practice than keeping it in the bank.

RESULTS AND DISCUSSION

The base model results which show the financial feasibility of the investment at the prevailing, a) market interest rates, b) coir fibre pith prices, c) nut prices and d) labor wages, are set out below.

(i) Base Scenario

The cost and benefits were calculated for a smallholding since CRI recommendations are directly aimed at such units owned by individual growers (Abeygunawardena et al, 1994-1995). The incremental NPV was Rs 16 982 per ac per 6 years or Rs 2 830 per ac per year. Therefore, this project was financially viable. BCR was 1.72, denoting that if a grower invests one rupee on coir fibre pith mulching he would earn Rs 1.72 as a return for the investment. When the BCR is more than one a project is regarded as being financially feasible. Therefore, this project is financially sound. IRR was 62%. Hence it is more profitable to invest the money on coir fibre pith mulching than in a bank at the current (February, 2003) interest rate of 8%. An IRR of 62% also implies that the project would be financially feasible even when money for the investment has to be borrowed at an annual interest rate of 62%.

The sensitivity of the project to changes in selected parameters is explored in the next section.

(ii) Sensitivity analysis

The price of coconut and coir fibre pith, and the interest rate generally varies with time. Such variations, no doubt, impact on the financial feasibility of the project and could even make it unprofitable. Therefore, possible worse case scenarios such as reductions of the price of coconuts by 25% to 50%, increases in coir fibre pith price by 25% to 50% were considered for the sensitivity analysis. The results of the sensitivity analyses are presented in Tables 3 and 4.

Sensitivity to changes in the price of coconuts

If the coconut price decreases by more than 45%, which is not unlikely in Sri Lanka, the project turns out to be not worthwhile (Table 3). Hence, this project could be regarded as being quite sensitive to changes in the price of coconuts.

Table 3: Sensitivity to coconut price changes

Coconut price change	NPV (Rs/ac/6 years)	BCR	IRR (%)
If increased by 50%	35 509.44	2.50	107
If increased by 25%	26 245.48	2.11	86
Base scenario	16 981.52	1.72	62
If decreased by 25%	7 717.57	1.33	35
If decreased by 46%	-64.16	0.99	8
If decreased by 50%	-1 546.39	0.93	2

Sensitivity to changes in the price of coir fibre pith

Although, the price of coir fibre pith is an important factor, it is less crucial than the price of coconuts in determining the profitability of the project. The project becomes unprofitable only when the price of coir fibre pith rises.

Table 4: Sensitivity to coir pith price changes

Coir pith price change	NPV (Rs/ac/6 years)	BCR	IRR (%)
If increased by 50%	8 748.78	1.27	30
If increased by 25%	12 865.15	1.46	45
If increased by 102%	-22.91	0.99	8
Base scenario	16 981.52	1.72	62
If decreased by 25%	21 097.89	2.07	84
If decreased by 50%	25 214.26	2.63	115

by 102% (Table 4). This low sensitivity is due to the relatively small quantity of coir fibre pith required to maintain a 5 cm thick mulch. Over the 5-year period, only two applications (about 14 four-wheel tractor loads each) were required per acre.

Sensitivity to changes in the interest rate

The financial feasibility is less sensitive to variations in the interest rate as evidenced by the relatively higher IRR (62%) at base scenario.

Mulching with coir fibre pith is an environment friendly practice. The mulch protects the soil surface from the sun and wind, prevents or reduces soil erosion, land degradation and elevated soil temperatures, and enhances microbial activity, etc. Decaying coir fibre pith replenishes the organic matter content in the soil and improves soil quality, which in turn contributes to enhancing coconut yields. Had these environmental benefits also been explicitly considered in this analysis, the project would have certainly been more appealing.

Mulching with coir fibre pith calls for a substantial investment. The first application of coir fibre pith in 1997 amounted to an investment of Rs 1 888 per acre, inclusive of the costs of the pith, its transport from fibre mill to the plantation and labor for application. The corresponding figure for the second application, in year 2000, was Rs 5 081. Easy access for growers to credit facilities will encourage them to undertake this environment friendly, productive and profitable practice.

CONCLUSION

An analysis of primary data of a field experiment conducted from 1997 - 2002, and using input and output prices of that period demonstrated the financial feasibility of utilizing a coir fibre pith mulch as a ground cover in a 13-year-old coconut plantation in an Andigama series shallow soil. Of the three parameters tested the investment was most sensitive to a decrease in coconut prices. Sensitivity to increases in the price of coir fibre pith and the interest rates was low.

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ANNEX

Table A1: Incremental costs and returns of using a Coir fiber pith mulch as a ground cover (T5) versus the Standard estate practice – *B. brizantha* controlled by slashing 4 times a year (T2), in a coconut plantation (planted in 1984) on Andigama Shallow soils

	Year 1 1997			Year 2 1998			Year3 1999		
	No. of units	Unit price (Rs)	Total	No. of units	Unit price (Rs)	Total	No. of units	Unit price (Rs.)	Total
OUTPUT									
• Yield of T5 (nuts/ac/yr)	-	-	-			1 984			2 624
• Yield of T2 (nuts/ac/yr)	-	-	-			2 240			4 416
• Incremental gross income from coconut (Rs/ac/yr)			0	256 nuts	7.92/nut	2 040	1 792nuts	8.43/nut	15 107
Weeding									
• T2 cost of slashing @ 15 coconut squares/ md (Rs/ac)	17 md	102/md	1 741	17 md	116/md	1 988	17 md	133/md	2 275
• T5 – cost of applying herbicides @ 10 tanks/md/ac,3 times/yr (Rs/ac)	3 md	102/md	306	3 md	116/md	349	3 md	133/md	400
• Supplying water for mixing herbicides @ 0.5wd/ac (Rs/ac)	1.5 wd	102/wd	153	1.5 wd	116/wd	175	1.5 wd	133/wd	200
• Herbicide-Round up @ 206 ml/15 coconut squares (Rs/ac/yr)	2.5 l	563/l	1 433	2.5 l	366/l	932	2.5 l	364	928
Saving due to decreased cost of weeding (Rs/ac/yr)			-151			532			748
Total incremental gross income (Rs/ac/yr)			**-151**			**2 572**			**15 854**
INCREMENTAL COSTS									
• Applying coir fibre pith @ 17 md/45 coconut squares	18.5 md	102/md	1 888						
• Collecting, counting & stockpiling picked nuts			-	0.12 md	116/md	14	0.82 md	133/md	109
• Harvesting			-	1 ac	60/ac	60	1/ac	70/ac	70
• Coir fibre pith (# of 4WT loads/45 coconut squares)	11 4WT loads	500/load	5 444						
• Internal field transportation			-	256 nuts	110/1000 nuts	28	1 792 nuts	115/1000 nuts	206
Total incremental cost (Rs/ac/yr)			**7 393**			**112**			**396**
Total incremental net income (Rs/ac/yr)			**-7 544**			**2 460**			**15 454**

Cont.....Table A 1

Description	Year 4 2000 No.of units	Unit price (Rs)	Total	Year 5 2001 No. of units	Unit price (Rs)	Total	Year 6 2002 No. of units	Unit price	Total
OUTPUT									
• Yield of T5 (nuts/ac/yr)			6 208			5 056			4 544
• Yield of T2 (nuts/ac/yr)			4 480			4 160			3 200
• Incremental gross income from coconut (Rs/ac/yr)	1728 nuts	4.17/nut	7 206	896 nuts	8.31/nut	7 446	1344 nuts	12.05/nut	16 195
Weeding									
• T2 - Cost of slashing @ 15 coconut squares / md (Rs/ac)	17 md	133/md	2 275	17 md	182/md	3 102	17 md	182/md	3 102
• T5 – cost of applying herbicide @ 10 tanks/md/ac, 3 times/yr (Rs/ac)	3 md	133/md	400	3 md	182/md	545	3 md	182/md	545
• Supplying water for mixing of herbicide @ 0.5wd/ac (Rs/ac)	1.5 wd	133/wd	200	1.5 wd	182/wd	273	1.5 wd	182/wd	273
• Herbicide-Round up @ 206 ml/15 coconut squares (Rs/ac/yr)	2.5 l	283/l	722	2.5 l	358/l	911	2.5 l	408	1 040
Saving due to decreased cost of weeding (Rs/ac/yr)			954			1 373			1 244
Total incremental gross income (Rs/ac/yr)			**8 159**			**8 819**			**17 440**
INCREMENTAL COSTS									
• Applying coir fiber pith @ 17 md/45 coconut squares	38.1 md	133/md	5 081						
• Collecting, counting & stockpiling of picked nuts	0.79 md	133/md	106	0.41 md	182/md	75	0.52 md	182/md	112
• Harvesting	1 ac	90/ac	90	1 ac	90/ac	90	1/ac	90/ac	90
• Coir fiber pith (# of 4WTloads/45 coconut squares)	16 4WT loads	850/load	13 883						
• Internal field transportation	1728 nuts	120/1000 nuts	207	896 nuts	125/1000 nuts	112	1344 nuts	130/1000 nuts	175
Total incremental cost (Rs/ac/yr)			**19 368**			**277**			**377**
Total incremental net income (Rs/ac/yr)			**-11 208***			**8 542**			**17 063**

Notes: *md - man days, wd - woman days, 4 WT - four wheel tractor*
*The negative value in total incremental net income in the 4th year is due to the repeat application of coir fiber pith.
Some totals may appear erroneous due to rounding off